The National Atmospheric Deposition Program: lessons from a continental-scale monitoring network.

National Atmospheric Deposition Program

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Abstract

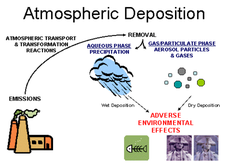
Since 1978, the National Atmospheric Deposition Program (NADP) has tracked the status and changes in the many different chemical compounds within precipitation across the continent. The NADP monitors the removal of pollutants from the atmosphere; but more importantly, it monitors the addition of chemical compounds into the Biosphere and ecosystems of North America, and now with sites in Taiwan and in South America. Our primary charge has been to provide data for the determination of both spatial and temporal trends in chemical species and mercury wet-deposition fluxes for North America. And over the 35 years of monitoring, we have shown the value of consistent monitoring techniques, high quality assurance standards, and rigorous attention to procedures and data validation. This has allowed us to reliably quantify both small and large trends in several chemical species.

It is clear that the addition of acidic compounds to ecosystems has dropped drastically over the past three decades, but that certain regions are still experiencing high acidic compound loading. Our data also show that nitrogen deposition is increasing, and in particular to very sensitive ecosystems. Additionally, we are noting the heavy regional increases in nitrogen deposition are due to ammonium increases. Finally, we can now show the approximate distribution of mercury input to ecosystems over North America and slight but quantifiable trends in this deposition. While mercury deposition is not important to human health while in the atmosphere, it is of extreme importance to human health as it moves through ecosystems.

For this poster, we will explain the networks that make up the NADP, provide specifics of each network, and provide a few lessons learned for making networks operate and making data useful for scientists and policy makers.

Network Description

NADP is a *cooperative* research program funded by federal, state, local and tribal agencies and private organizations.



Five Networks

1. National Trends Network (NTN),
2. Atmospheric Integrated Research Monitoring Network (AIRMoN),
3. Mercury Deposition Network (MDN),
4. Atmospheric Mercury Network (AMNet), and
5. Ammonia Monitoring Network (AMoN).

A long running USDA National Institute of Food and Agriculture (previously CSREES) research project located at the University of Illinois.

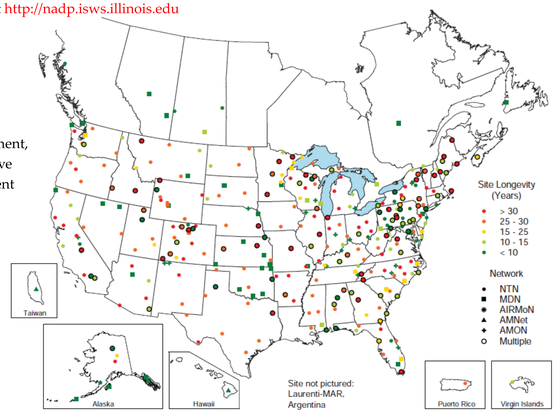
The NADP's ***mission*** is to determine the chemical climate of North America with emphasis on current status and long-term trends.

	NTN	AIRMoN	MDN	AMNet	AMoN
Years of Operation	36	21	18	5	4
# of Active Sites	266	6	116	24	66
Collection Frequency	weekly	event based	weekly	continously	two week
Analytes	$SO_4^=$, NO_3^- NH_4^+, pH, Ca^{2+}, Mg^{2+}, K^+, Na^+, Cl^-; PO_4^{3-}		Hg	Gaseous Elemental Hg Gaseous Oxidized Hg Particulate Bound Hg	NH_3
Analytical Lab	Central Analytical Laboratory, UI		Frontier Global Sciences, Seattle WA	instrument-based, no lab analysis	Central Analytical Laboratory, UI

All NADP data is available at http://nadp.isws.illinois.edu

Other keys to success:

- Governance by all sponsors
- Members choose to join, own the equipment, control sites, and have long-term commitment



Sustained and Diversified Funding

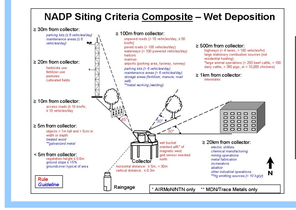
Keys include:

- member commitment (5+ years)
- diversity of funding organizations

Continuous Quality Assurance

Keys include:

- Full-time Quality Assurance Manager,
- Annual review (AND *follow-up*) of each part of the process,
- External field & lab quality assurance programs (USGS),
- Written operating procedures
  - o Field SOPs
  - o Lab procedures
  - o Data procedures
  - o Quality Management Plan, etc.
- Site Liaison and equipment repair (i.e. help)

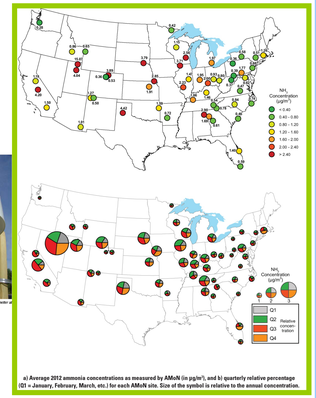


New Directions (networks, analytes, calculations)

a. Ammonia Monitoring Network (AMoN)

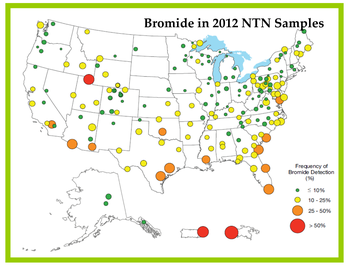
Measurements

- two week average concentration of atmospheric Ammonia (NH_3)
- using passive monitor



a) Average 2012 ammonia concentrations as measured by AMoN (in μg/m³), and b) quarterly relative percentage (Q1 = January, February, March, etc.) for each AMoN site. Size of the symbol is relative to the annual concentration.

b. Bromide Wet Deposition



c. Calculation of Mercury Dry Deposition

Coming Soon:

Dry Deposition Estimates

- flux (F) = *air concentration* x *dry deposition velocity* (V_d)

$$V_d = \frac{1}{R_a + R_b + R_c}$$

- R_a *as aerodynamic resistance,* R_b *as quasi-laminar resistance, and* R_c *as canopy resistance*

Environment Canada

Lessons Learned….

1. The most important "employee" is the operator (who in many cases is a volunteer).
2. Funding commitment (long term, decades…..).
3. Funding diversification (for when #2 fails).
4. Open and inclusive governance.
5. Patience.
6. Open data release, and if people believe your data, then they will use it, and #1 and #2 follow.

The NADP is National Research Support Project-3: A Long-Term Monitoring Program in Support of Research on the Effects of Atmospheric Chemical Deposition. More than 250 sponsors support the NADP, including private companies and other nongovernmental organizations, universities, local and state government agencies, State Agricultural Experiment Stations, national laboratories, Native American organizations, Canadian government agencies, U.S. Federal agencies (USGS, NOAA, EPA, TVA, NPS, FWS, BIA, USDA-FS, and USDA_NIFA). Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author and do not necessarily reflect the views of the sponsors or the Illinois State Water Survey.

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